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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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EXAMINER

PHAN, TRONG Q

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/075,484

Applicant(s)

BHATTACHARYYA, ARUP

Examiner

TRONG PHAN

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-88 is/are pending in the application.
- 4a) Of the above claim(s) 85-88 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-84 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Drawings

1. The drawings are objected to because each of the labels FLOATING GATE in Fig. 1; GND and 12V in Figs. 3-4; SOURCE ELECTRODE (SE) in Fig. 14 Prior Art should be associated with an arrow in order to clearly indicate which element in the drawing it is corresponded to. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 216, 220, 1.1ev, 9ev, 5.0ev and 5.7ev in Fig. 2; 1.1ev, 9ev, 5.0ev and 5.7ev in Figs. 3-4; 10 M SEC in Fig. 5; n and ARROW INDICATES EXPERIMENTAL RATIOS in Fig. 9 Prior Art. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 2.5 E6 V/CM (line 25, page 16; line 11, page 17); 4E6 V/CM (line 8, page 17) (Vsx) (lines 1, 12 and 22, page 18); 1 to 10msec (line 5, page 18); 7E6 V/CM (lines 23-24, page 20); 12E6 V/CM (line 24, page 20); PE (line 11, page 25); SE (line 12, page 25); 1424 (line 16, page 24). A proposed drawing correction or corrected

drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities: Figs. 9-12 and 14 are not described as Prior Art. Appropriate correction is required.

Claim Objections

5. Non-elected claims 85-88 are objected to because of the following informalities: they should be canceled in response to the office action. Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

No antecedent basis for "the floating charge-storage region".

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-84 are rejected under 35 U.S.C. 103(a) as being unpatentable over

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Hong et al., 5,445,984, in view of Kato et al., 4,495,219, Bertin et al., 5,617,351, Bass, Jr. et al., 4,870,470, Wolf et al., 4,717,943, Nguyen et al., 5,510,278, and Forbes, 5,852,306.

Hong et al., 5,445,984, discloses in Fig. 2 a non-volatile flash EEPROM device comprising:

p-type substrate 21;

n-type source region 36';

n-type drain region 36'';

tunnel oxide layer 22;

charge-storage region/floating gate 24;

dielectric layer 26;

control gate layer 28;

sidewall 38 of oxide-nitride-oxide (ONO);

wherein: obviously, a number of source lines, a number of control gate lines, a number of bit lines and an inherent processor must be included in order to program the flash EEPROM device as well known in art.

What is not shown in Fig. 2 of Hong et al., 5,445,984, is the Tantalum Oxide (Ta_2O_5) layer formed on the tunnel Silicon Dioxide SiO_2 (as claims 1, 4, 6, 8, 14-16, 22, 25, 28, 31, 34, 40-41, 66-68, 71, 74, 77-79 and 81-83), the floating plate including silicon rich oxide (SRO), the floating plate including silicon rich nitride (SRN) and the injector silicon rich nitride (SRN) (as claims 9-15 and 35-41).

Kato et al., 4,495,219, discloses in Fig. 26 a non-volatile memory device (see lines 51-54, column 80) including: an upper dielectric layer of Tantalum Oxide (Ta_2O_5) layer 89' being formed on a lower dielectric layer of Silicon Dioxide (SiO_2) layer 90' in the channel region (see lines 28-45, column 1 and lines 20-26, column 8).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 1 of Hong et al., 5,445,984, by Kato et al., 4,495,219, for the purpose of increasing the breakdown voltage and decreasing the leakage current (see lines 52-57, column 1 of Kato et al., 4,495,219).

What is not shown in Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, is the floating plate including silicon rich oxide (SRO) (as claims 9 and 35) and the floating plate including silicon rich nitride (SRN) (as claims 11-12 and 37-38).

Bertin et al., 5,617,351, discloses in Fig. 2a the teaching of using the floating gate FG including silicon rich oxide (SRO) or silicon rich oxide (SRN) in a non-volatile EEPROM device (see lines 32-40, column 7).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, by Bertin et al., 5,617,351, for the purpose of minimizing the voltage necessary to transfer electrons onto and from the floating gate (see lines 40-46, column 7 of Bertin et al., 5,617,351).

What is not shown in Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, and Bertin et al., 5,617,351, is the Zirconium Oxide (ZrO_2) layer (as claims

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1, 5-6, 8, 13, 15-16, 23, 25, 29, 31, 34, 39, 41, 66-68, 72, 74, 77-79 and 84) and aluminum control gate (as claims 25, 66, 68, 77 and 79).

Bass, Jr. et al., 4,870,470, discloses the teaching of disposing a layer of zirconium oxide in between the control gate and the floating gate of a non-volatile memory device (see lines 37-50, column 1) and the teaching of using aluminum control electrode (see lines 49-51, column 8).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, and Bertin et al., 5,617,351, for the purpose of preventing the floating gate not to be directly coupled to a source of applied potential and allowing the floating gate to assume its own voltage state (see lines 46-50, column 1 of Bass, Jr. et al., 4,870,470) and the purpose of just a matter of design choice.

What is not shown in Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, Bertin et al., 5,617,351, and Bass, Jr. et al., 4,870,470, is the injector silicon rich nitride (SRN) (as claims 13-15 and 39-41).

(1) Wolf et al., 4,717,943, discloses in Figs. 1-2 a non-volatile memory device including an upper injector silicon rich dielectric layer 20 being formed underneath control electrode 12 and a lower injector silicon rich dielectric layer 22 being formed in between upper silicon dioxide SiO₂ layer 16 and lower silicon dioxide SiO₂ layer 18 (see lines 55-65, column 2).

(2) Bertin et al., 5,617,351, discloses the teaching that a silicon rich dielectric can be an injector silicon rich nitride (SRN) (see lines 62-63, column 5).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, Bertin et al., 5,617,351, and Bass, Jr. et al., 4,870,470, by the above teaching (1) of Wolf et al., 4,717,943, and the above teaching (2) of Bertin et al., 5,617,351, for the purpose of having an insulator at low field and a conductor at high field (see lines 56-62, column 1 of Wolf et al., 4,717,943). It should be noted that the upper silicon dioxide SiO₂ layer 16 of Wolf et al., 4,717,943, can be a Tantalum Oxide (Ta₂O₅) because they are both dielectric layers in view of Kato et al., 4,495,219, (see lines 41-45, column 1 of Kato et al., 4,495,219).

What is not shown in Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, Bertin et al., 5,617,351, Bass, Jr. et al., 4,870,470, and Wolf et al., 4,717,943, is the NH₃ treated SiO₂ and the NO treated SiO₂ (as claims 2-3, 26-27 and 69-70).

Nguyen et al., 5,510,278, discloses the teaching of forming the gate dielectric layer of silicon dioxide in an ambient comprising ammonia NH₃ or nitric oxide NO (see lines 14-25, column 3).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, Bertin et al., 5,617,351, Bass, Jr. et al., 4,870,470, and Wolf et al., 4,717,943, by the teaching of Nguyen et al., 5,510,278, for the purpose of just a matter of design choice.

What is not shown in Fig. 2 of Hong et al., 5,445,984, which is modified by

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Kato et al., 4,495,219, Bertin et al., 5,617,351, Bass, Jr. et al., 4,870,470, Wolf et al., 4,717,943, and Nguyen et al., 5,510,278, is the floating plate of silicon nano crystal (as claims 34, 63 and 83).

Forbes, 5,852,306, discloses in Fig. 3 the teaching of using floating gate 310 of silicon nano crystalline film in a flash non-volatile memory device (see lines 47-61, column 4).

It would have been obvious under 35 USC 103(a) to one of ordinary skill in the art at the time of the invention was made to modify Fig. 2 of Hong et al., 5,445,984, which is modified by Kato et al., 4,495,219, Bertin et al., 5,617,351, Bass, Jr. et al., 4,870,470, and Wolf et al., 4,717,943, and Nguyen et al., 5,510,278, by Forbes et al., 5,852,306, for the purpose of having a larger bandgap (19-21, column 4 of Forbes et al., 5,852,306).

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

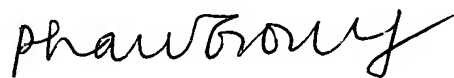
Chang, 6,101,131, Prall et al., 6,288,419, Wu et al., 4,794,565, Kaya et al., 5,646,430, Gardner et al., 6,169,306, Hoffman, 4,449,205, Yi, 5,455,792, and Lin et al., 6,127,227.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TRONG PHAN whose telephone number is (703) 308-4870. The examiner can normally be reached on M-F (8:30-5:00).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (703) 308-4910. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-4021 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



**TRONG PHAN
PRIMARY EXAMINER**

May 23, 2003